

THURSDAY, DECEMBER 7, 1905.

THE PRINCIPLES OF HEREDITY.

The Principles of Heredity, with Some Applications.

By G. A. Reid. Pp. xiii+359. (London: Chapman and Hall, Ltd., 1905.) Price 12s. 6d. net.

THE publication of this book marks an epoch in the history of the relation between medicine and biology, inasmuch as it is an embodiment of the recognition by medical men that they depend ultimately for a precise knowledge of nature on the professional biologist—who may or may not, at the same time, be a medical man.

The book should be welcomed by doctors as containing in the earlier chapters a straightforward though rather brief account of theories of organic evolution, and by biologists as giving a very full account of the medical aspect of these problems, and by both as an interesting collection, under the title of "The Principles of Heredity," of a mass of information and ideas connected with that phenomenon.

The reader may object to the antithesis between medicine and biology, but will, we hope, withdraw his objection when it is explained that all that is meant by it is the antithesis between applied and pure biology.

The recognition by medical men of the value to them of the information with which the biologist is able to supply them is unquestionably a good thing; yet it is a curious illustration of the fact that a new movement of opinion cannot stand isolated and alone, cannot be without consequences of one kind or another, that one result of the popularity of the *entente* between the doctor and the biologist may prove harmful to biology, and through it perhaps ultimately to medicine.

The danger is that the biologist, pure and simple, the man who works at his subject for the mere joy of investigation and discovery, may cease to exist. So many workers of this type are becoming applied biologists, whether they be sporozoologists devoting themselves to malaria, students of heredity to eugenics, or cytologists to cancer. We do not, of course, complain of the application of biological knowledge; it is obviously fitting and right that as much use should be made of it as possible. But we do complain loudly of the opinion that the application of such knowledge is, or should be, the ultimate goal of him who acquires it. Huxley strongly insisted on the fact that the fruits, useful to mankind, of the tree of natural knowledge fell unsought for and unexpected on the back of the head of some obscure worker under its shade, and never to him who worked there with outstretched palm. Dr. Reid says, p. 331,

"Hitherto the nature of their training has tended to render medical men excessively conservative. Nevertheless they have already assimilated and put to magnificent practical use one of the two great scientific achievements of the age—Pasteur's discovery

of the microbic origin of disease. The other great achievement, Darwin's discovery of the adaptation of species to the environment through natural selection, has hardly been assimilated, and certainly put to no practical use as yet. Both these discoveries should have been made by medical men."

The fact that they were not is an illustration of the truth of Huxley's words.

Let it be emphasised again that we do not hold that the gradual desertion of biologists from the ranks of the pure to those of the applied is other than of the greatest service to mankind. But if this desertion means that the opinion that the natural goal of the young biologist is to obtain a position in applied biology will grow, it is a bad thing for science. So that even if it is only on the ground that the utilitarianism which may lead to the extinction of the pure biologist is a bad one, it is to be deplored. If we are going to be utilitarians let us at least be good ones, and let us recognise the demonstrable fact that the only way in which the knowledge and consequent control of nature can be acquired is by encouraging the existence of the type of man who works at his subject for its own sake. Let us have less of the talk about the profound significance of such and such a branch of investigation to the sociologist and the statesman and more of the frame of mind which finds expression in Bateson's words:—"We are asked sometimes, Is this new knowledge any use? That is a question with which we, here, have fortunately no direct concern. Our business in life is to find things out, and we do not look beyond."

With regard to this utilitarianism Dr. Reid appears to us to steer the right course in his book, except, perhaps, that he sails rather too near it when, pointing out that a classical education is inefficient and does not make us like the Greeks and Romans, he says,

"the true modern representatives of the great Pagans are not to be found in college halls or country parsonages, but in thinkers and workers like Darwin, Huxley, Kelvin, Cecil Rhodes, the strenuous men who rule Egypt and India. . . ."

Surely the patient inquiring spirit which prompts a man to devote himself to classics is the same as that in the heart of the true man of science. One of the greatest steps forward in the study of heredity itself was made by a monk.

Dr. Reid's book is tolerably free from that looseness in the use of scientific terms which is common enough in purely scientific works, but which is simply rampant in books on popular science.

The reader who wishes to familiarise himself with the subject of heredity should be very careful to distinguish between the two meanings of the term regression, the one which is a purely biological phenomenon and the other which is a purely statistical conception. With regard to the use of that much-abused word "law," our author makes a statement that at first sight seems to show that he has not thought very seriously about the meaning of that

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word. But we do not believe our author wishes to be taken seriously here:—

“Even if we postulate a Deity as the Originator of all things, yet the whole history of science, which is that of civilisation, proves that it is more profitable to seek the *explanation of natural phenomena in natural laws (His laws) than in infractions of them—in miracles.*” (The italics are mine.)

We have one fault to find; in a work on the principles of heredity one would have expected a fuller discussion than is actually given of biometric and Mendelian methods of dealing with that phenomenon: medical men reading the book will get a very meagre idea of the nature of the investigation being carried on and of the definite results already achieved by these two sets of workers.

Dr. Reid does good service in dealing a blow at that teleology which is the curse of biological science by exposing the falsity of the old idea that the “object” of bi-parental reproduction is to ensure a sufficient degree of variability in each generation for natural selection to operate upon. He cites as evidence for this Dr. Warren’s work on *Daphnia magna*; but does not refer to a more recent and more complete demonstration of the same truth by the same author in the case of *Aphis*, to be found in *Biometrika*, vol. i., p. 129.

These, however, are trifles, and do not detract from the value of the book as a whole. A. D. D.

MATHEMATICAL LECTURES FOR AMERICAN MATHEMATICIANS.

The Boston Colloquium. Lectures on Mathematics.

By Edward Burr Van Vleck, Henry Seely White, and Frederick Shenstone Woods. Pp. xii+188. (New York: The Macmillan Company, 1905.)

Price 2 dollars net.

Lectures on the Calculus of Variations. By Dr.

Oskar Bolza. Pp. xvi+272. (Chicago: The University Press, 1904.) Price 4 dollars net.

AMONG the many ways in which the American Mathematical Society has endeavoured to popularise and develop the study of higher mathematics, not the least remarkable and useful is the practice of holding “colloquia” in connection with the summer meetings at intervals of two or three years. It had been felt that the mere reading of a long string of disconnected papers does not produce much lasting impression on the minds of the audience. On the other hand, even a short course of university lectures will often adequately cover a wide range of mathematical study. The society therefore decided in 1896 to arrange for courses of three to six two-hour lectures, each dealing with a substantial part of mathematics. Four such colloquia have been held, at Buffalo in 1896, at Cambridge in 1898, at Ithaca in 1901, and at Boston in 1903. At each of the first three two courses of lectures were given, and Prof. Oskar Bolza’s course on “The Simplest Type of Problems in the Calculus of Variations,” given at the Ithaca colloquium of 1901,

forms the basis of one of the two volumes before us. The chapters nearly follow the historic order laid down in the introduction, which is also in close conformity with a logical sequence of treatment. The study of the first and second variations of an integral naturally leads to Weierstrass’s examination of the conditions for a minimum and the distinction between a “strong” and a “weak” minimum, a terminology introduced by Kneser. The next steps are represented by Weierstrass’s theory of parameter representation, Kneser’s general theory based on the properties of geodesics, and Hilbert’s existence-theorem. For Weierstrass’s work (much of which is contained in unpublished courses of lectures) the author has had recourse to his own notes of a course (by Weierstrass) which he attended in 1879, as well as to several other sets of lecture notes, including one on Prof. Schwarz’s lectures at Berlin on the same subject.

At the next colloquium, held at Boston in September, 1903, three courses of lectures were given. The year marked the fiftieth anniversary of the appointment of Prof. John Monroe Van Vleck to the chair of mathematics at Wesleyan University, and it was fitting to the occasion that all the lecturers were Van Vleck’s pupils, one of them being his son. Prof. Henry S. White, of North-Western University, is responsible for the course of three lectures on “Linear Systems of Curves on Algebraic Surfaces,” Prof. Frederick S. Woods, of the Massachusetts Institute of Technology, for three lectures on “Forms of Non-Euclidian Space,” and Prof. Edward B. Van Vleck, of Wesleyan University, for six lectures on “Selected Topics in the Theory of Divergent Series and Continued Fractions.” A bibliography of literature on continued fractions extending over twenty pages concludes the last named discourse.

Long formulæ involving x and y are like little children—they ought to be “seen and not heard.” The success of these colloquia when originally delivered must have been in some considerable measure due to the extent to which the authors have succeeded in dealing with ideas and their symbolical representations without giving tedious demonstrations *in extenso*.

INDUSTRIAL REFRIGERATION

Modern Refrigerating Machinery, its Construction, Methods of Working, and Industrial Applications.

By Prof. H. Lorenz. *American Practice in Refrigeration.* By H. M. Haven and F. W. Dean. Pp. x+396. (New York: Wiley and Sons; London: Chapman and Hall, Ltd., 1905.) Price 17s. net.

IT is to be regretted that no treatise exists on this subject which contains an exhaustive investigation of the thermodynamical problems involved, and of the physical properties of the various gases used as media, with special reference to their practical application to refrigerating machinery. In works on thermodynamics, the matter is treated in general terms. The physical constants are found in scattered